Battlefield Visualization: Warfighting Requirements

Prairie Warrior 1996 Advanced Warfighting Experiment (AWE)

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Introduction

The TRADOC Analysis Center (TRAC) helped the Battle Command Battle Laboratory (BCBL) to investigate several aspects of battlefield visualization (BV) during advanced warfighting experimentation (AWE) in fiscal year 1996. This experimentation was conducted using the Command and General Staff Officer Course (CGSOC) Battle Command Elective (BCE) and Prairie Warrior (PW) exercise. The purpose of this paper is to document the salient findings resulting from TRAC's analysis of BV during this period.

To focus experimentation, the BCBL asked:

- Do advanced BV capabilities improve the warfighting capabilities of commanders and staffs?

The BCBL hypothesized that advanced BV capabilities improve the warfighting capabilities of commanders and staffs by providing improved products while decreasing their decision cycle time. To test this hypothesis and to answer the BCBL study question, the following approved PW 96 AWE issue was used to focus the data collection.

- How do advanced BV affect the warfighting capabilities of Mobile Strike Force (MSF) commanders and staffs?

This paper focuses on several components of BV that affect the warfighters' capabilities - information elements, information display capabilities, and automated tools. Most of the information derived from the experimentation related to these BV components. Further, I will link these components to insights from past experimentation, to help answer whether warfighting capabilities are improved by these BV capabilities, and where we have to go to reach objectives of the program.

Battlefield Visualization

I adhered to the following definition and salient portions of TRADOC Pam 525-70, *Military Operations: BATTLEFIELD VISUALIZATION CONCEPT,* to address the issue above.

> *Battlefield Visualization: The process whereby the commander develops a clear understanding of the current state with relation to the enemy and environment, envisions a desired end state which represents mission accomplishment, and then subsequently visualizes the sequence of activity that moves the commander's force from its current state to the end state.*

BV is both art and science. As an essential leadership attribute of the commander, BV is critical to mission accomplishment. Determining critical information requires focus on three aspects of the commander's vision. First is the ability to understand the current state of friendly and enemy forces. Second is the ability to clearly discern a desired end state. Third is the ability to see and understand the dynamic relationship between the opposing forces. This includes

envisioning possible enemy moves. During mission execution, the commander continually assesses the envisioned end state to ensure that it is still both desired and achievable. It is critical that there is a connection between current operations and the future plan, and that the commander articulates a battlefield vision through a clear intent statement.

Technology is focused in four areas to support BV. First, total mission awareness (which is supported by the force common picture) encompasses friendly and enemy forces, noncombatants, the physical environment, and, more specifically, terrain visualization. Second is mission planning, rehearsal, and execution. Third is future technology requirements which must be developed and integrated into the Army Battle Command System (ABCS). These include digital terrain, display devices, communications, computers, and networks. The fourth area is technology integration.

Battle staffs are organized to ensure the command process is sustained. The staffs must understand what information the commander deems important for the decisionmaking process. The staffs assist the commander by collecting, assessing, analyzing, and discarding information not relevant to the operation. The staff's role shifts from preparing reports to synthesizing information in accordance with the priorities specified or implied in the commander's intent. Technological means integrate and synchronize the vision through the real-time transmission of a common picture of the battlefield made relevant to the echelon of command receiving it. The commander validates the integrated battlefield vision. The commander personally accounts for the factors of enemy intentions, friendly morale, and fatigue as they directly impact the level of combat power.

BV, above all, supports battle command. BV is holistic in nature and must be analyzed from this perspective. The myriad of linkages among findings in the areas of doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS) must be recognized to understand the full implications of any single action on BV.

Methodology

I used four sources of data and information to support this analysis. The first source was observation. A multidisciplinary team of data collectors gathered information on observable command and staff processes and actions during two simulation exercises (SIMEXs) and PW. Next, I administered a survey to selected staff officers of the MSF. This survey derived information concerning requirements for information elements, information displays, and automated tools for battlefield visualization. It is presented in the appendix, along with the results of the data tabulation. Third, I attended after-action reviews (AAR) to hear the exchange of information and ideas among instructors, students, data collectors, controllers, technology developers, and concept developers. Finally, I examined selected student logs made available to me by the BCE course author to understand students' course perceptions, and to confirm data collector observations.

Methodology - Data Sources

- ***Direct Observation***
- ***Information Requirements Survey***
- ***AARs***
- ***BCE Student Logs***

The survey is the key information source for this paper. I used it to both focus the observation effort and to then logically connect disparate observations. I will clarify the use of the survey as a tool to fuse various information on BV later in the paper.

Results

The results will be discussed relative to key findings emanating from each of the three simulation-driven exercises. Relevant linkages among DTLOMS and prior experiments will be discussed as topics arise.

Key Findings - SIMEX 1.

The large screen display requirement was revalidated. An *InFocus Power View* projector system set up at the commander's command and control vehicle (C2V) supported the MSF commander and key staff during the exercise. This system projected the MSF's relevant common picture (RCP) from an MCS/P onto a slide projector screen. This field solution to the requirement for a large screen (Size) display proved effective because it provided the commander and staff a view of the entire MSF battlespace and a collaborative venue for decisionmaking. Later, several flat panel displays of different sizes were provided to the MSF. The selected staff who were surveyed did not recognize the priority of this requirement. Only one member selected this tool as most critical to battle command from the perspective of their assigned position, while 16 respondents selected it as least critical or not critical to them. However, the selected respondents were all staff and the large screen display requirement is largely commander and team collaboration in nature. The large screen display requirement was revalidated during SIMEX 2

during which the MSF commander collaborated on a 1:100,000 map in the mechanized brigade with its staff. This was necessitated partly by the brigade's failure to receive the division RCP all day and partly because the map provided a view of the entire MSF battlespace. The commander and staff continued to effectively use 1:100,000 scale maps during PW to monitor the current battle and to plan the future battle. This scale map on a single display provided visualization of the entire division battlespace - deep, close, and rear. The extended space for which the MSF is responsible by concept, and over which its sensors and deep attack systems can range, requires a large-sized display. Furthermore, the commander and staff continued to frequently collaborate around one large screen display or another to make decisions throughout the operations.

Large Screen Display
- ***Provides View of Extended Battlespace***
- ***Enhances and Facilitates Collaboration***

The MSF commander identified a requirement to track fragmentary orders (FRAGO). He wanted a mechanism to be developed to keep track of FRAGOs because they were expected to proliferate as operational tempo increased. This indicated the continuing need for the automated system and doctrine to be adaptive and flexible to support the information-based commander and staff. The need for user-friendly database management capabilities has been documented for several years. The key is that an exhaustive list of user requirements may not be possible to develop prior to experience with such a complex, integrated system.

Battle Command System Must Be Adaptive and Flexible

Key Findings - SIMEX 2.

Two major shortcomings with the division RCP were noted during SIMEX 2 . The first was that the RCP did not support decisionmaking in tactical operations center (TOC) A (the division executing TOC in the organizational concept employed) regarding the close fight during the MSF's transition to phase 2 of the operation. Specifically, there was inadequate detail for the commander and staff on enemy forces at that time and in that particular area of the battlespace. The command group also noted that the rear area battle picture on the RCP was lacking. Enemy situation and friendly activity were again ranked high by this set of survey respondents, as these have always been. This points to the flexibility required in the system - regardless of any system's basic capability to store and to display friendly and enemy units, for maximum effectiveness the system must display various echelons of forces throughout the battlespace.

A serious problem emerged regarding the synchronization of plans through the MSF echelons. The MSF headquarters identified (on the division RCP) named areas of interest (NAI) and target areas of interest (TAI) on the division operational graphics. Subsequently, but during parallel planning for the division operation, the aviation brigade named their subordinate NAIs the same as division (NAI 1, etc.). When directed to look at NAI 4 by division, the aviation brigade

staff personnel were looking at the wrong area of the battlefield. Thus, regardless of the automation provided to the command and staff, the tactics, techniques, and procedures (TTP), and the standard operation procedures (SOP) will be required to make the system, as a whole, work effectively. Battle command and the support of the commander will remain a human-based endeavor, regardless of the proliferation or advancement of technology.

The need for the dynamic display of critical elements or events was evidenced. This requirement has been evidenced in prior experimentation, although manifested in various ways. This has been because there has been no capability provided to do this without significant work. In SIMEX 2 corps battle simulation (CBS) icons were not subdivided into small enough discrete units for the division staff to track a battalion air assualt. It was critical to know the status of the battalion's units throughout the assault. However, because there was essentially no dynamic display capability of the unit's assault elements, the command and staff were blind to the status of this operation for approximately half an hour. Dynamic display was identified as a requirement to support the RCP as a result of analysis of 1994 experimentation, revalidated in 1995, and explicitly documented both years.

Dynamic Display Requirement Revalidated
- ***Enhances Situational Awareness***
- ***Supports Predictive Analysis***

The "white board" collaborative requirement was revalidated. The MSF commander stated that the "white board" tool was needed to execute any collaborative sessions on MCS/P which were virtually colocated. He needed the ability for pointing and interactive marking, which that type of tool provides. Again, the surveyed staff did not recognize the priority of this requirement. Five members selected this tool as most critical to battle command from the perspective of their assigned position, while 14 respondents selected it as least critical or not critical to them. In this case, the students did not have the opportunity to experience the effects of the capability. In the prior year of experimentation, this was the key collaborative tool for the MSF. This is a reason the basic BV requirements must be developed across multiple conditions, events, and time.

White Board Revalidated
- ***Enhances and Facilitates Collaboration***
- ***Supports Clarification of Commander's Intent***

The MSF commander demonstrated an innovative use of the suite of battle command systems during the SIMEX. At one point, it was not certain that the forward area air defense command, control, and intelligence (FAADC2I) system was working. The MSF commander directed that the FAAD weapons and C2I system be checked, relative to what was being reported on it by checking Comanches that were known to be up in the air within FAAD coverage at that

time. This indicated the synergy which would be possible by using various components of systems in an integrated manner.

Key Findings - Prairie Warrior.

MSF Commander and Division.

The MSF doctrinally used commander's critical information requirements (CCIR) as the force-level information collection management tool. The disciplined use of CCIR as an information collection tool proved to be very effective for the MSF. CCIR provide a tool by which the adverse effects of information overload, brought about by the proliferation of sensors and information processors, can be mitigated. The ability to discern critical information was determined to be an essential cognitive skill for BV. CCIR is a tool which can focus the discernment effort or can manage that information gathered for the commander, who must be presented with precise information sets to make decisions in an information-based environment. CCIRs were documented in the operations plan by phase. Subsequently, when the MSF went to a branch plan based on the changing situation, the planned phases were no longer germane. At this point, the G3 dynamically adjusted friendly force information requirements (FFIR) to meet the objectives and decision points in the new phases. The MSF commander drove the intelligence collection effort throughout by explicitly stating priority intelligence requirements (PIR) to the G2, who explicitly linked them to decision points and then adjusted them by phase during the operation as required. Late in the operation, the G2 focused the division's intelligence collection and analysis efforts by the use of "focus areas", but these remained oriented on the commander's PIR.

Division CCIR

- ***The Division Information Collection Management Tool***
- ***Focused the Division RCP***

The MSF developed the RCP based on the CCIR. The Combat Information Center (CIC) modified the RCP throughout the exercise, as directed by the MSF commander. This RCP was essentially a division situation map, disseminated digitally throughout the division. The division RCP provided a common, consistent view of the division battlespace throughout the MSF. The basic RCP showed friendly and enemy units (usually battalion center of mass) and some maneuver graphics (e.g., boundaries, phase lines) overlaid on digital terrain. The CIC made further information available to the MSF in the form of attachments to the basic RCP when it was disseminated.

The MSF had a goal to update the RCP every 30 minutes. During the last two days of PW (13 and 14 May), the CIC most closely achieved the objective production interval (mean of 24.4 minutes). The minimum interval of 13 minutes was recorded on 14 May. An interval of 15 minutes was achieved twice on 9 May and once on 11 May. An updated RCP was disseminated at these short intervals to take advantage of significant information changes which had been captured. During each SIMEX and PW, the RCP update interval was recorded. The table below

presents the RCP update interval statistics. During SIMEX 1 and 2, the game time and real time were nearly equivalent, so that there was not a question of which time to use in recording the interval. However, because CBS was running so slowly during the early stages of PW, the recorded update interval was the actual time between updates. As indicated by the lower mean times during PW, staff cohesion, enhanced by training and the further experience of working together, improved the timeliness of both the production and the dissemination of the RCP. Training in the full capabilities of the available systems (MCS/P in this case) was evidenced as the foundation for these shorter intervals. However, the higher coefficient of variation (CV) for Prairie Warrior indicates that there was still a wide variation in the production interval of the RCP, even after the two precursor training opportunities. Although longer intervals which were contrary to the MSF's goal of 30 minutes were the predominant factor for the wide variation, some shorter intervals resulting from successful staff actions also contributed to a small degree. This event-driven dissemination of the RCP was based on reaction to battlefield events.

	SIMEX 1	SIMEX 2	PW 96
Number	9	10	65
Minimum (Minutes)	35	25	13
Maximum	135	115	147
Mean	75	57.5	48.2
Standard Deviation	38.7	28.1	31.1
Coefficient of Variation	0.52	0.49	0.64

The MSF commander directed several modifications to the RCP over the course of the exercise. At one point, he stated that he required the following in the RCP to support him and the division to execute the modified plan for Phase 2 of the operation: a baseline modified combined obstacles overlay (MCOO), Red and Blue battalions, friendly obstacles, and friendly weapons' range fans. He further stated he needed the brigades' security zone forces shown on the RCP. Thus, the commander demonstrated that the RCP must be flexible and tailorable, even when it is focused on a single echelon and functional area.

The MSF commander also identified the need for units adjacent to the MSF, including II Corps units and the ACR, to be shown on the RCP. Adjacent unit information has always been identified in these experiments as a priority requirement. The lack of this information pointed to the need for interoperable systems or robust liaison to be proliferated across adjacent units, whether these units be Army, joint, or coalition in nature. After a higher headquarters mandated a boundary change, there was a special interest in viewing this new division boundary through the echelons of the MSF. The MSF required these boundaries and boundary changes to be disseminated digitally among the MSF.

The Division RCP

- ***Common, Consistent Force-Level View of the Battlespace***
- ***Flexibility and Tailorability Required***

Red ADA system range fans were required when the enemy was in the offense so the MSF Commander could assess the threat of major enemy formations closing with the MSF ground maneuver brigades. This information was needed to exploit enemy air coverage vulnerabilities with friendly air attacks. Range fans were also identified as a requirement to support the RCP as a result of analysis of 1994 experimentation, revalidated in 1995, and explicitly documented both years.

During the exercise the MSF commander used the commander's real-time display (CRTD) for several purposes. The CRTD provides real-time air tracks based on airborne warning and control system (AWACS) radar detections and identifications. First, as envisioned, he and the air defense staff used it to track enemy air incursions of various types into the MSF battlespace (including tactical ballistic missiles). Second, the commander used it to verify friendly air assets' locations during the battle. The real-time dynamic display of both enemy and friendly air assets provided the MSF commander instant visualization of a component of the third dimension (3D) in and beyond his battlespace. As opposed to the perishability of most other information displays throughout the MSF, this dynamic display was based on a continuous real-time feed. This capability enabled the MSF commander to make timely decisions regarding imminent air threats and also to assess whether friendly activity was proceeding according to plan.

Continuing Visualization Requirements

- ***Range Fans***
- ***Dynamic Displays***

Virtual capabilities provided to the MSF proved to be very effective. These capabilities are those which present real-time views of areas of the battlespace to a system operator. In the experiment, there were two virtual systems that stood out - the Virtual UAV and the CRTD. The use of virtual UAVs for targeting by division artillery (DIVARTY) was observed to be very effective. A virtual UAV from the motorized brigade was assigned in direct support of DIVARTY. It provided a near-real-time view of the battlefield to enhance the responsiveness of indirect fires. The virtual UAV's field of view was favorably cited and the system noted as an excellent intelligence source for the aviation brigade.

Three dimensional capabilities provided to the MSF proved to be less effective than the virtual ones. These capabilities are those which present 3D views of areas of the battlespace to a system operator. In the experiment, there were two systems with 3D capabilities that stood out - MCS/P and TEM/E-OPS.

MCS/P included several prominent tools to visualize in three dimensions or to see the effects of 3D analysis. *Field of view* allows the user to specify and visualize a general wedge-shaped range fan of space that can be viewed by an observer at a point on the ground. *Line-of-sight* shows the observer a scene of the heights of obstacles to show what can and cannot be seen from a location. *Flyover* shows the user a specified 3D perspective view of a battlespace scene, as if flying over it from a high elevation. These MCS/P 3D features were not observed to

be used much by the MSF. This was probably because of a relative lack of formal training on these features, consisting basically of one afternoon's exposure to these features. There were also some minor problems observed with the software (primarily with the *Hide* function used with groups of lines). However, the observed limited exploitation of the features showed that this type of tool can be useful. As an example, the armor brigade engineer used them to help him position tanks and obstacles.

TEM/E-OPS workstations were located in the MSF's mobility and survivability (M/S) brigade, division support command (DISCOM), TOC B, and II Corps main command post. Limited numbers of TEM/E-OPS created overlays and products were passed electronically between these staffs and workstations in the M/S brigade area. It was used in the DISCOM to analyze main supply routes (MSR) and to support convoy planning. TEM/E-OPS workstations were used extensively to plan movement routes for maneuver forces and to plan logistics resupply convoys, to *virtually* fly through air corridors, and to establish defensive positions. Line-of-sight checks were also made on TEM/E-OPS. Further, it was used effectively to print hard copy thematic maps for use throughout the MSF. This system provided detailed terrain analysis capabilities and interfaced with MCS/P.

MCS/P could use Arc Digitized Raster Graphics (ADRG), Digital Terrain Elevation Data (DTED), Digital Features Analysis Data (DFAD-older/hand drawn data), and limited Interim Terrain Data (ITD) data sets, but had little capability to manipulate the data. The capability to process remotely sensed data set TEM/E-OPS apart.

Several additional required information elements stood out during the exercise. Blue unit combat strength, as opposed to total MSF strength, was desired by the commander, assistant division commander (ADC), and G3. The purpose was to provide better input to make an assessment of the MSF's combat potential. Battle damage assessment (BDA) data were particularly needed, especially once the MSF became decisively engaged. Information on enemy locations, derived from joint surveillance and target attack radar system (JSTARS) moving target indicator (MTI) data, was key to deciding to implement a branch plan. Various nuclear, biological, and chemical (NBC)-related data were another critical type of information passed digitally within the MSF. This information included NBC 1, NBC 2, and NBC 3 reports, and hazard overlays.

Selected Major Subordinate Commands.

The MCS/P, as the command and control system for the maneuver battlefield operating system (BOS), demonstrated a broad range of functionality. It is maneuver-oriented and focused on satisfying the division commander's information requirements. Various shortcomings were observed by data collectors relative to the system's satisfaction of requirements in BOSs other than the maneuver BOS. However, this paper will not discuss those requirements, but will remain focused on maneuver C2 requirements.

The aviation brigade cited a need for an automated function to deconflict airspace and fire support coordination measures. Although the advanced field artillery tactical data system

(AFATDS) provided this functionality, army airspace command and control (A2C2) functionality was generally lacking on the MCS/P. This was a major area of concern to the MSF. This area of concern was cited during the 1995 experimentation along with the method the MSF employed that year to mitigate system shortcomings. Notably, the aviation brigade used TEM/E-OPS to view flight routes and engagement areas they were planning to attack.

Aviation Requirements
- ***A2C2 Functionality Needed***
- ***TEM/E-OPS Terrain Analysis Capabilities Exploited***

The armor brigade used a more complete suite of army tactical command and control system (ATCCS) equipment than the other brigades. They viewed both enemy and friendly locations extensively. They also chose to view fire mission targets in their zone, and BDA resulting from target engagement. During the exercise, the armor brigade demonstrated clearly that integrated battle command systems had a synergistic effect for a well trained staff.

ATCCS Integration
- ***Synergistic Effects Demonstrated***
- ***Support to Battle Command Facilitated and Enhanced***

Information Survey Results.

As stated prior, TRAC administered an information requirements survey to 40 selected members of the MSF staff. These selected personnel included six staff members at the division level from the division's executing TOC. I also selected 27 personnel from the major subordinate commands (armor, mechanized, motorized, and aviation brigades, as well as DIVARTY and DISCOM), the division cavalry squadron, military intelligence battalion, and engineer brigade. The purpose of this survey was to help to determine the highest priority information elements as perceived by this MSF staff. Further, information was collected this year with this instrument regarding the prioritization of the information displays and automated tools required. Surveys from 36 respondents were validated for analysis.

Information Elements.

Twenty-five information elements were ranked by the selected MSF staff. Two prior studies had determined that these elements represented high-priority information elements for division battle command. Of the 25 elements ranked, the six highest priority information elements from this survey and the definition considered for each are presented in the table below.

Of the six highest ranked elements, only the element Obstacles/Barriers was not common to the top ten ranked elements in both this survey, and an 83 element set ranked both by the 1994 BCE students and a group of general officers in 1985. With some minor

exceptions to provide further specification to some of the elements, the elements ranked in this current survey were those highest ranked elements from the set of 83. Generalizing from the results of this survey, it remains clear that it is most important to know where the enemy is, what the friendly force is supposed to do, how it will do it, and the geography relevant to the force. The complete tabulation results are in the appendix.

The survey also asked respondents to identify the most critical element and the second most critical element to display on the RCP. The element "enemy situation" was first in each category, while "friendly activity" was noted second most often in each category. "Friendly activity" was ranked tied for seventh of the 25 total elements, using the ranking procedure described previously. These results were consistent with the previously stated generalization of information requirements. The tabulation of all responses to these questions is in the appendix.

I also used this survey to examine the issue of information freshness, both from the perspective of the users' *concern with freshness*, and their *confidence in the freshness* of the RCP display and the underlying data. The tabulation, shown in the appendix, revealed that most respondents had some concern with the freshness of the underlying data or the RCP display. Most respondents had some confidence as well. Observations during past experimentation had hinted that the achievement of consistent RCP timeliness would come after the achievement of systems' integration, and the resultant capability to load and display basic data.

The information elements which most concerned users in terms of their freshness were positively correlated with the high priority elements - those of highest priority were of most concern with regard to their freshness. In other words, the MSF respondents associated freshness with relevancy for those elements of information deemed critical components of the RCP.

Information Element	Definition
Enemy Situation	Enemy unit locations.
Concept (Scheme of Maneuver)	A general plan for the execution of commander's intent.
Battlefield Geometry (Boundaries)	Control measures drawn along identifiable terrain features used to delineate areas of tactical responsibility and control.
Obstacles/Barriers	Any natural or manmade object that canalizes, delays, restricts, or diverts movement of a force.
Terrain	The topography, natural obstacles, and other physical and cultural entities of a geographic area.
Command Mission/Intent	The primary task assigned to a unit or force. Usually contains who, what, and where, but seldom specifies how.

Information Display Capabilities.

Twenty-five information display capabilities were ranked by the selected MSF staff. I believed these capabilities represented the most important for battle command. This set was based on the graphics and display requirements of the tactical decisionmaking process, as cited in FM 101-5. Of the 25 display capabilities ranked, the five highest priority capabilities from this survey and the definition considered for each are presented in the table below. Again, the complete tabulation results are in the appendix.

Information Display	Definition
High Payoff Targets	High value targets that a friendly commander determines will contribute significantly to the accomplish of the mission if destroyed
Enemy Weapons Range Fans	A graphical representation of selected enemy killing systems, depicting enemy system coverage
Enemy Sensor Range Fans	A graphical representation of enemy sensor coverage, depicting enemy sensor patterns and area coverage
COA Sketches	Grahic information included in the Course of Action decision-making process
Mobility Corridors	Terrain that allows the movement of a combat force

Automated Tools.

Twenty-one automated tools were ranked by the selected MSF staff. I believed that these tools represented the most important of those brought into battle command experimentation over the past several years. I developed this set of tools to support the tactical decisionmaking process. Of the 21 display capabilities ranked, the seven highest priority capabilities from this survey and the definition considered for each are presented in the table below. Again, the complete tabulation results are in the appendix.

Automated Tool	Definition
E-Mail	Electronic mail messaging capability
Overlay transfer	Allows transfer of overlays from one echelon to another or across functional areas throughout the force
Digital mapping	Automated systems mapping capability based on digital terrain data
Light pen	An interactive collaborative digital marker
Alarms	Visual warnings or audible tones which alert friendly system users of the occurrence of various events
Dynamic display	Displays showing the real-time movement of entities
Scalable maps	Allows the viewing of the digital map at varying map scales

Conclusions

The results discussed herein continue to point to a core set of battle command support and, now, BV requirements. These will be summarized in this section by the areas of focus from the information requirements survey.

Information elements.

Regardless of how these requirements were initially determined or revalidated, the consistency of the core set of information elements is unmistakable. During several years of battle command experimentation, I have found that, although there is a consistent core of required elements, flexibility and tailorability are essential characteristics of the total set of data elements comprising any force-level database.

As stated prior, the priority information requirements point to the need for balanced, two-sided situational awareness. The commander needs to know where the enemy is, what their strength is, and what the enemy intent is. Further, the commander needs to know where all relevant friendly forces are and their asset status. Friendly forces must also all be synchronized regarding their understanding of commander's intent.

Information display capabilities.

The elements must be brought together in coherent information presentations, whether textually, visually, or audially oriented. This presentation is where the automated tools bring together required information elements, providing relevant support to the commander's tactical decisionmaking.

The information survey this year provided clear indications that a presentation of key enemy units or facilities (represented by high payoff targets) and the imminent enemy threat (represented by range fans) are critical. Several of the other high-ranked display capabilities (e.g., mobility corridors, situation map) point to the value of the RCP, as it was developed during this year's experiment.

Automated information tools.

There must be a robust information system (hardware and software) underlying any commander's decison support system. The requirements for such a system must be developed from a holistic perspective, linking diverse tools, perhaps with sometimes disparate purposes, to develop an integrated suite focused on supporting the commander. The experiment this year demonstrated again that hands-on experience with emerging technology is required to fully understand and exploit available capabilities.

Based on various experiments in battle command, the tools requirements for ABCS which support BV appear valid. Notable requirements include the digital map, e-mail, and an office automation suite, as well as a robust, user-friendly database management system.

Appendix

Information Requirements Survey

BATTLE COMMAND ELECTIVE
INFORMATION REQUIREMENTS SURVEY

1. **Purpose.** The purpose of this survey is to obtain your view on three aspects of information requirements which drive the development of the Army's battle command decision support systems. First is the *information elements* required for decision-making by commanders throughout the division. Second is the *information display capabilities* required for battle command. Third is the *automated information tools* incorporated in such a system to facilitate use of information available to the command and staff. Your responses are positively influencing the course of the battle command experiments over the years, the subsequent analysis of these experiments, and resulting developmental efforts.

2. **Instructions.** This survey is designed to solicit input from selected staff members of the Mobile Strike Force regarding the three aspects cited above. Your responses should reflect your views on the level of criticality of the listed requirements based upon your previous battle command experience and your experience during the BCE. Although your responses are identified by your MSF assignment, *specific responses or comments will not be attributed to any individual.*

a. For each of the attached three sets of requirements (*information elements, information display capabilities, automated information tools*) indicate the most critical and least critical to you relative to supporting tactical decisionmaking. Do this by marking exactly five that you must have in the first column and marking exactly five that you can do without in the last column. Thus, mark ten of the listed requirements on each attachment.

b. Please read through each list of requirements and the respective definitions before you begin rating them. Take no more than twenty minutes total to complete this survey.

c. Please return this survey to your respective BOS mentor prior to your departure on the last day of SIMEX 2 (12 April).

MSF Assignment _____

1. Please take a moment to consider the 25 information elements shown in the table below. Then, using the Yes column, mark the 5 which you consider most critical to the development of the Relevant Common Picture from the perspective of your position in the MSF during the course of the entire BCE experience. Then, using the No column, mark exactly 5 elements which were least critical or not critical to you. Thus, mark 5 information elements which you could not live without and 5 you could (10 marks total).

Information Elements	Yes	~	No	Mean	Rank 96	Rank 94
Enemy Situation	25	11	0	1.31	1	2
Concept (Scheme of Maneuver)	19	15	2	1.53	2	7
Battlefield Geometry (Boundaries)	14	17	5	1.75	3	7
Obstacles/Barriers	11	21	4	1.81	4	14
Terrain	16	11	9	1.81	4	7
Command Mission/Intent	8	26	2	1.83	6	5
Friendly Activity	9	22	5	1.89	7	17
Intelligence Summary	10	20	6	1.89	7	13
Avenues of Approach	7	25	4	1.92	9	15
Order of Battle	7	25	4	1.92	9	11
Enemy Weapon Systems	5	28	3	1.94	11	23
Command/G2 Guidance (PIR)	8	21	7	1.97	12	1
Area of Operations	8	20	8	2	13	4
Critical Terrain (Location/Description)	4	27	5	2.03	14	10
Enemy Mission Objective/Intent	3	28	5	2.06	15	2
Friendly Weapons Assets	8	18	10	2.06	15	17
Enemy Activity	3	26	7	2.11	17	5
Friendly RISTA Assets	1	30	5	2.11	17	17
Enemy RISTA Assets	1	29	6	2.14	19	23
Friendly Aviation Assets	2	27	7	2.14	19	17
Axis of Advance	1	28	7	2.17	21	17
Adjacent Unit	4	17	15	2.31	22	11
Task Organization	3	18	15	2.33	23	23
Friendly Logistics Assets	2	18	16	2.39	24	17
Weather Data	1	12	23	2.61	25	15

2. Regarding the prior set of information elements, what is the *single most critical element* to display on the Relevant Common Picture (RCP)?

Information element Enemy Situation (14), Friendly Activity (6), Concept (5)

3. Regarding the prior set of information elements, what is the *second most critical element* to display on the Relevant Common Picture (RCP)?

Information element Enemy Situation (7), Friendly Activity (6), Concept (3), Friendly Weapons Assets (3), and Intelligence Summary (3)

4. Based on your pre-CGSOC Army experiences and your experience throughout the Battle Command Elective (BCE), do you require any additional information elements, beyond those listed in the table above, to build the RCP? Please list no more than three additional elements.

Information element(s) No Responses.

5. The RCP updates are always marked with a date-time-group. The underlying data on which the RCP is based may exhibit varied degrees of "freshness" (data or information displayed continue to be relevant in that the information is correct, having been updated as necessary to reflect changes). Regarding the freshness of the underlying data or the RCP display itself, do you have any concerns? Indicate below.

No Concern	2	Some Concern	24	Much Concern	9

6. Given the core set of information elements in the table above, what is your confidence in the freshness of information displayed on MCS/P?

(0)	**I had TOTAL confidence in the "freshness" of the RCP display and underlying data**
(27)	**I had SOME confidence in the "freshness" of the RCP display and underlying data**
(6)	**I had NO confidence in the "freshness" of the RCP display and underlying data**

7. Given that you have any concerns with freshness list below no more than 3 information elements (from the table above) that were of most concern to you.

Information element(s) Enemy Situation (8), Current Enemy Positions (7), Current Friendly Positions (5), Friendly Situation (5), Adjacent Unit (3), Enemy Activity (3), Timelines on RCP Update (3)

8. Again, please take a moment to consider the 25 information display capabilities shown in the table below. Then, using the Yes column, mark the 5 which you consider most critical to battle command from the perspective of your position in the MSF during the course of the entire BCE experience. Then, using the No column, mark exactly 5 capabilities which were least critical or not critical to you. Thus, mark 5 information display capabilities which you could not live without and 5 which you could (again, 10 marks total).

Information Display Capabilities	Yes	~	No	Mean	Rank 96
High Payoff Targets	21	13	2	1.47	1
Enemy Weapons Range Fans	20	12	4	1.56	2
Enemy Sensor Range Fans	15	21	0	1.58	3
COA Sketches	17	16	3	1.61	4
Mobility Corridors	15	18	3	1.67	5
Doctrinal Event Template	10	25	1	1.75	6
Engineer Support Plan/Graphics	7	28	1	1.83	7
NBC - 3 Hazard Warning	10	20	6	1.89	8
Situational Event Template	7	26	3	1.89	8
Air & Missile Warning	10	19	7	1.92	10
Situation Map	4	30	2	1.94	11
Obstacle Overlay	8	20	8	2	12
CSS Plan/Graphics	3	28	5	2.06	13
Decision Support Template	6	21	9	2.08	14
Fire Support Plan/Graphics	5	22	9	2.11	15
Graphic Reports	5	22	9	2.11	15
Operations Overlay	3	24	9	2.17	17
Friendly Sensor Range Fans	1	27	8	2.19	18
Air Defense Plan/Graphics	3	22	11	2.22	19
Friendly Weapons Range Fans	1	26	9	2.22	19
Graphic Intelligence Collection Plan	3	22	11	2.22	19
Operational Graphics	4	19	13	2.25	22
Airspace Control Overlay	4	18	14	2.28	23
Slow-Go/No-Go Terrain	2	21	13	2.31	24
Synchronization Matrix	1	20	15	2.39	25

9. Did you require any additional information display capabilities, beyond those listed in the table above, for battle command in the MSF? Please list no more than three additional capabilities.

Information display capability(ies) Templating function (2), BDA report tool (2)

10. Again, please take a moment to consider the 21 automated information tools shown in the table below. Then, using the Yes column, mark the 5 which you consider most critical to battle command from the perspective of your position in the MSF during the course of the entire BCE experience. Then, using the No column, mark exactly 5 capabilities which were least critical or not critical to you. Thus, mark 5 information display capabilities which you could not live without and 5 which you could (again, 10 marks total).

Automated Information Tools	Yes	~	No	Mean	Rank 96
E-Mail	25	11	0	1.31	1
Overlay transfer	22	12	2	1.44	2
Digital mapping	18	17	1	1.53	3
Light pen	14	20	2	1.67	4
Alarms	13	20	3	1.72	5
Dynamic display	12	22	2	1.72	5
Scalable maps	12	22	2	1.72	5
Wargaming tool	9	19	8	1.97	8
3-D terrain viewer	7	21	8	2.03	9
Freshness indicator	6	23	7	2.03	9
Office automation suite	7	20	9	2.06	11
Grid overlay	4	25	7	2.08	12
Video teleconferencing (VTC)	4	24	8	2.11	13
Air & missile warning	5	21	10	2.14	14
White board	5	17	14	2.25	15
NBC warning & reporting	6	14	16	2.28	16
COA evaluator	2	20	14	2.33	17
Voice recognition software	2	20	14	2.33	17
Large screen (size) display	1	19	16	2.42	19
Weather effects tool	1	18	17	2.44	20
3-D fly-through	4	11	21	2.47	21